Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2015/03/jls.htm
2015 Vol. 5 (S3), pp. 668-676/Kiyani et al.
Research Article

STUDYING THE EFFECT OF A PERIOD OF AEROBIC EXERCISES ON MINIMAL COGNITIVE IMPAIRMENT OF MIDDLE-AGED WOMEN

Roghayeh Kiyani[1], *Alireza Saberi Kakhki[2] and Ramin Amirsasan[3]
[1]*International Imamreza University*
[2]*Department of Motor Behavior, Faculty of Physical Education and Sport Sciences, Ferdowsi University of Mashhad, Mashhad, Iran*
[3]*Department of Exercise Physiology, University of Tabriz, Iran*
**Author for Correspondence*

ABSTRACT
The present research has been carried out in order to investigate about the effect of an aerobic exercise period on minimal cognitive impairment of middle-aged women. 30 middle-aged women who were suffering from minimal cognitive impairment and came to Science University, brain, nerve, and psychology ward and had symptoms of criteria accessible were selected and MMSE (minimal cognitive impairment status) test was administered among them. The testes were exposed to maximum heart beat with a moderate intensity of %65 to %70 in aerobic exercise condition. The data resulting from the comparison of cognitive assessment in different stages were investigated through multiple variable covariance analysis and through frequent measurement. The statistical results showed that by eliminating the effect of pretest, aerobic exercises did have a meaningful effect on reducing minimal cognitive impairment and a meaningful difference between scores in different administration and follow up stages showed that the long-term aerobic exercises have reduced cognitive impairment.

Keywords: *Aerobic Exercises, Minimal Cognitive Impairment*

INTRODUCTION
The middle ages for the women is along with maximum psychological-social performance, biological changes, changes in health status, changes in job, and transferring periods such as menopause, and being abandoned by children and usually a combination of complex impressions and several different response patterns to changes during these years is seen (Dennerestin *et al.*, 2000). Physiologic changes along with menopause such as sleep disorders, reduction of concentration, and memory chaos resulting from behavioral problems arising from harmonic fluctuations and life conditions make women vulnerable against the most common dementia (Alzheimer) in old ages. The term dementia refers to chronic decay of intelligence or cognitive performances especially learning and remembering and also oratory disorders, eyesight-hearing problems, cognitive decision making capacity, analysis and problem solving (Adams & Victorrs, 2002). Dementia is not observed suddenly and with complete cognitive impairment in most cases, but it is seen in the form of minimal cognitive impairment (IMC) in first stages. Biochemical changes and nervous impairment of cognitive performance may be created even 20 years before the time when clinical symptoms of the disease appear. The term MCI refers to minimal impairment to moderate impairment in cognitive performance especially memory. In fact, the clinical appearance is the mean state between normal old women and old women suffering from dementia through which memory is specifically impaired along with other impairments. Studies show that individuals suffering from MCI are in high risk of being infected by Alzheimer in future (Bradly *et al.*, 2004). The main reasons for suffering from cognitive impairment are not known. But evidences show that the factors that cause Alzheimer affect the formation of MCI. Being higher than 60 years old, having an individual suffering from dementia impairment through family history, being fat, and suffering from vascular diseases such as high blood pressure, blood fat, diabetes, heart diseases, and brain strokes, also narcotic misuses and alcohol use, the reduction of social cognition, and physical passive activities in lifestyles are among factors affecting the infection by Alzheimer impairment and minimal cognitive impairment (Knopman, 2003). Different researches show that in many cases, in time recognition and the treatment of minimal cognitive

impairment in middle-age period prevents suffering from this disease. From among the treatment methods, movement activity has been approved by many scholars and researchers in the field in treating cognitive impairment due to low costs and almost all encompassing, consistent, and without unwanted side effects (Lorad *et al.*, 2011; Nagahara, 2009; Bernn *et al.*, 2009; Cottman, 2007; Daniel, 2006; Adllard *et al.*, 2005; Heyn, 2004; Colomb, 2003; Caro *et al.*, 2001; Farara, 1999). Studying the effect of aerobic exercises with different intensities and time periods in treating minimal cognitive impairment among middle-aged women and men has been approved in researches carried out by Varla *et al.*, (2012); Baker *et al.*, (2010); Scherder *et al.*, (2005). Brer *et al.*, (2013) carried out a study on the effect of physical activities and exercises in reducing and preventing the cognitive impairments on old people. The results of the study suggest that physical activities are considered as non-medicinal and useful intervention to prevent cognitive impairments related to the age and Alzheimer and other dementias (Lorad *et al.*, 2010; Lautenschlager *et al.*, 2008; Rockwood *et al.*, 2007; Larson *et al.*, 2006). On the contrary to the consensus among the researchers regarding the useful effects of sports, aerobic exercises have not been determined as the most effective sports programs to reduce minimal cognitive impairment yet. Meanwhile, there are controversies about the two factors of intensity and the duration of exercises among the researchers' viewpoints (Doway *et al.*, 1998). Regarding the importance of the middle-ages for the women that is along with behavioral and emotional fluctuations related to the age and gender, lack of complete treatment of Alzheimer and the possibility of treatment of this disease considered in MCI impairment and the gaps in researches on the time period determined to administer aerobic exercises and its effect in minimal cognitive impairment has been the main problem in this study regarding the effect of a period of aerobic exercises when minimal cognitive impairment happens among middle aged women.

MATERIALS AND METHODS

Methodology

Population and Sample

The population for the present research includes all middle-aged women who have had the following characteristics: 50 to 65 years old, guidance school graduates to diploma graduates, BMI (extra weight of between 25 and 30 kg.), lack of narcotic consumption, lack of having heart and cardiovascular diseases. In this research, middle-aged women who came to brain and nerve ward in medical sciences university of Tabriz and psychology and psychiatry clinics were chosen to be among the sample.

Research Tools

- *Minimal Cognitive Status Test (MMSE)*

MMSE is a tool used mostly by neurologists and was created by Flostein (1975). This tool assesses the individual's directionality regarding time and location, remembering capability, short-term memory and calculation capability precisely. By using 83 cut points the sensitivity and appropriation of this test were estimated to be %87 and %82, respectively (Antoni *et al.*, 1982; cited in Bradely). 11 items are included here and they are divided into two parts.

The first part is the verbal responses for routing, memory and care. And the second part includes reading and writing and the capability to copy a spatial figure. The score 30 represents the cognitive health of an individual and below 17 shows minimal cognitive impairment. The internal validity of indexes has been reported to be between alpha 0.68 and 0.96.

The validity of post-test has been reported to be more than 0.80 in this test (Sajatovic & Ramirez, 2003). The validity and credibility of this test have been reported by Foroughan *et al.*, (2008) to be %78 and %91, respectively, in Iran.

- *Administration Method*

The testees were selected based on being accessible considering the conditions. The persons selected should have had a score of below 17 in MMSE test to be included as those who suffer from minimal cognitive impairment. Then the independent variable (aerobic exercises) for 45 minutes, 3 days a week for 3 months with a mean intensity of %65 to %70 of maximum hearth beats (Kashefi *et al.*, 2014; Cyartoo *et al.*, 2010; Baker *et al.*, 2009; Tiblet, 2002) was applied. Finally MMSE test was administered

for 3 months. Again the independent variable (aerobic exercises) was administered for 3 months. MMSE test was administered at the end of 6th and 9th month (posttest) either.

Exercise Protocol

10 minutes of startup exercises (including stretching and jumps) along with rapid movements and running, 10 minutes of movements on the ground and stretching and 5 minutes to cool down.

Hypothesis: A period of aerobic exercise affects cognitive impairment of middle-aged women.

Studying the hypotheses of covariance analysis:

A) Studying the Normality of Variables Distribution

Before investigating the hypothesis first we used non-parametric Kolomogorov-Smirnov test to study the normality of the distribution of variables and the results showed that the distribution of pretest scores and post test scores of minimal cognitive impairment of the test group and control group with normal distribution did not have a meaningful difference. Results of Kolomogorov-Smirnov test have been shown in table 1.

Table 1: Kolomogorov-Smirnov test results to investigate about the normality of data distribution of the variable minimal cognitive impairment for groups in isolation

Statistical indexes	The group with minimal cognitive impairment		Control group	
	Pretest	Posttest	Pretest	Posttest
Kolomogorov-Smirnov test amount	0.72	0.62	0.75	0.61
Meaningfulness	0.67	0.83	0.62	0.83

B) The Similarity of Regression Line Slope

Table 2: Results of the analysis of similarity of regression line slope as presupposition of covariance analysis

Changes' resource	Square roots	Degree of freedom	Mean of square roots	Amount of F	Meaningfulness level
Pretest	0.854	1	0.854	0.077	0.783
Pretest group	2.302	1	2.302	0.209	0.651
Error	286.530	26	11.020		

In table above and based on the results included, the meaningfulness level of reciprocal effect (p=0.651) has been greater than 0.05 and thus the regression convergence of the hypothesis is approved.

C) The Variances' being the Same Hypothesis

Table 3: Result of Loon test to study the sameness of variances

Amount of F	Degree of freedom 1	Degree of freedom 2	Meaningfulness level
0.003	1	28	0.95

Based on results in the table above, it can be observed there exist the convergence of variances of the two groups in an assurance level of higher than %95.

Table 4: Results of the covariance analysis of minimal cognitive impairment scores after pretest adjustment

Changes' resource	Square roots	Degree of freedom	Mean of square roots	Amount of F	Meaningfulness level	Ita square root
Pretest	1.834	1	1.834	0.171	0.682	0.006
Group	63.332	1	63.332	5.920	0.022	0.180
Error	288.832	27	10.697			
Total	13016.000	30				

Regarding the results gained (F=5.92, df=27, P=0.022) it could be shown that when the effect of pretest is eliminated from the posttest results related to groups, the difference between groups is meaningful in an assurance level of %95 and it can be concluded that aerobic exercise affects the improvement of minimal cognitive impairment symptoms of middle-aged women. The amount of It a square root shows that %18 of changes in minimal cognitive impairment scores in the group having minimal cognitive impairment (with differences in posttest) result from the administration of independent variable (aerobic exercises).
The difference in time period to administer aerobic exercises affects middle aged women's cognitive impairment.

Table 5: Results of multiple variable tests to study the mean difference of scores of cognitive impairment in pretest, 3 months later, 6 months later, posttest in groups having minimal cognitive impairment and control groups

	Test	Amount	F	Degree of freedom	Error's degree of freedom	Meaningfulness level
Cognitive impairment	**Pilae effect**	0.653	16.302[a]	3.000	26.000	0.000
	Labedai Wilks	0.347	16.302[a]	3.000	26.000	0.000
	Hetling effect	1.881	16.302[a]	3.000	26.000	0.000
	Greatest square root	1.881	16.302[a]	3.000	26.000	0.000
Cognitive impairment group	**Pilae effect**	0.716	21.838[a]	3.000	26.000	0.000
	Labedai Wilks	0.284	21.838[a]	3.000	26.000	0.000
	Hetling effect	2.520	21.838[a]	3.000	26.000	0.000
	Greatest square root	2.520	21.838[a]	3.000	26.000	0.000

The data in the table above show that all multiple variable tests are meaningful and this shows that the presence of main effect is related to the factor of test repetition and also there is interactional effect between groups and test.

Table 6: Results of Mokhli test to investigate about Kerowit hypothesis

The internal effect of testees	Mokhli amount	Chi2 amount	Degree of freedom	Meaningfulness level	Greenhouse-Geisser	Epsilon Huynh-Feldt	Lower-bound
Minimal cognitive impairment	0.908	2.584	5	0.764	0.936	1.000	0.333

As it can be observed Kerowit Mokhli test is not meaningful statistically and this shows that Keriwit's hypothesis is approved. Since Mokhli test is not absolute even when it is not meaningful statistically, the estimates by Greenhouse-Geisser and Huynh-Feldt were used that adjust freedom degrees.

Table 7: Results of internal effects of testees

	Resources	Total square roots	Degree of freedom	Mean square roots	F amount	Meaningfulness level
Minimal cognitive impairment	Sphericity Assumed	291.100	3	97.033	17.329	.000
	Greenhouse-Geisser	291.100	2.807	103.721	17.329	.000
	Huynh-Feldt	291.100	3.000	97.033	17.329	.000
	Lower-bound	291.100	1.000	291.100	17.329	.000
Minimal cognitive impairment*group	Sphericity Assumed	389.533	3	129.844	23.188	.000
	Greenhouse-Geisser	389.533	2.807	138.793	23.188	.000
	Huynh-Feldt	389.533	3.000	129.844	23.188	.000
	Lower-bound	389.533	1.000	389.533	23.188	.000
Error (cognitive impairment)	Sphericity Assumed	470.367	84	5.600		
	Greenhouse-Geisser	470.367	78.584	5.986		
	Huynh-Feldt	470.367	84.000	5.600		
	Lower-bound	470.367	28.000	16.799		

Regarding the results of the table above all statistical tests are meaningful in 0.01 level and this shows the existence of the main effect related to test repetition ($p<0.001$, $F=17.329$) and the interactive effect between groups and test repetition ($p<0.001$, $F=23.188$).

Table 8: Testing the effect between subjects to compare the mean of groups

Resources	Total square roots	Degree of freedom	Mean square roots	F amount	Meaningfulness level
Group	529.200	1	529.200	53.500	0.000
Error	276.967	28	9.892		

The amount of F equals 53.500 and it is meaningful in 0.001 level and this shows the difference between minimal cognitive impairment within 4 stages of pretest, 3 months later, 6 months later, and posttest between the two control and minimal cognitive impairment groups.

Table 9: Mean, standard error and assurance distance of %95 of minimal cognitive impairment scores in four stages regarding groups in isolation

Group	Cognitive impairment	Mean	Standard error	Assurance distance	
				Low bank	High bank
Minimal cognitive impairment	Pretest	14.733	.643	13.415	16.051
	3 months later	18.267	.805	16.619	19.915
	6 months later	19.600	.633	18.302	20.898
	posttest	22.133	.563	20.980	23.286
Control	Pretest	13.267	.643	11.949	14.585
	3 months later	17.933	.805	16.285	19.581
	6 months later	14.067	.633	12.769	15.364
	posttest	12.667	.563	11.514	13.820

In the table above the descriptive data including mean, standard error, and assurance distance of %95 of cognitive impairment scores in stages of pretest, 3 months later, 6 months later, and posttest in minimal cognitive impairment and control groups have been represented.

Table 10: Results of multiple variable test to investigate about the difference between means of scores of minimal cognitive impairment in stages of pretest, 3 months later, 6 months later, and posttest for groups in isolation

Group	Test	Total square roots	Degree of freedom	Mean of square roots	F amount	Meaningfulness level
Minimal cognitive impairment	**Pilae effect**	0.760	27.478[a]	3.000	26.000	0.000
	Labedai Wilks	0.240	27.478[a]	3.000	26.000	0.000
	Hetling effect	3.171	27.478[a]	3.000	26.000	0.000
	Greatest square root	3.171	27.478[a]	3.000	26.000	0.000
Control group	**Pilae effect**	0.552	10.663[a]	3.000	26.000	0.000
	Labedai Wilks	0.448	10.663[a]	3.000	26.000	0.000
	Hetling effect	1.230	10.663[a]	3.000	26.000	0.000
	Greatest square root	1.230	10.663[a]	3.000	26.000	0.000

Based on what is included in the table above, there has been a meaningful difference between the scores of cognitive impairment related to control and minimal cognitive impairment groups during different stages. These differences have been investigated in details in the following table.

Table 11: The couple comparison of the difference between cognitive impairment scores in four different stages of pretest, 3 months later, 6 months later, and posttest for groups in isolation

Group	Four stages		Difference between means	Standard error	Meaningfulness level
Cognitive impairment	Pretest	3 months later	-3.533*	.950	.005
		6 months later	-4.867*	.793	.000
		posttest	-7.400*	.795	.000
	3 months later	6 months later	-1.333	.932	.982
		posttest	-3.867*	.937	.002
	6 months later	posttest	-2.533*	.755	.014
Control	Pretest	3 months later	-4.667*	.950	.000
		6 months later	-.800	.793	1.000
		posttest	.600	.795	1.000
	3 months later	6 months later	3.867*	.932	.002
		posttest	5.267*	.937	.000
	6 months later	posttest	1.400	.755	.445

As it can be observed in the table above there has been a meaningful difference between cognitive impairment scores of minimal cognitive impairment and control groups in four different stages of pretest, 3 months later, 6 months later, and posttest. In control group there has been a meaningful difference between pretest and 3 months later and between 3 months later and 6 months later and 3 months later and posttest.

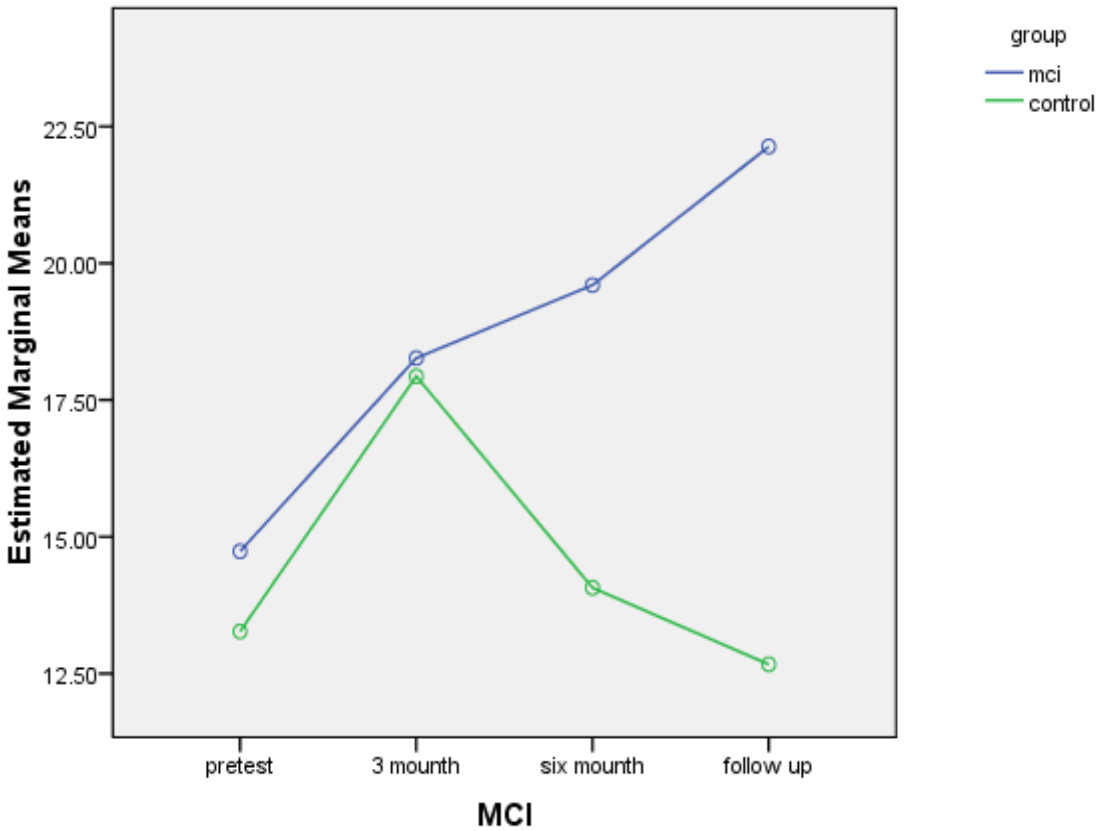

Figure 1-4: The graph of scores of minimal cognitive impairment in four stages of pretest, 3 months later, 6 months later, and posttest for groups in isolation

Discussion and Conclusion

The results of statistical analysis showed that the aerobic exercises have affected the reduction of minimal cognitive impairment. Results of this research accord with researches carried out by Brer *et al.*, (2013), Varla *et al.*, (2012), Lorad *et al.*, (2010), Baker *et al.*, (2010), Lotenlach *et al.*, (2008), Scheder *et al.*, (2005) regarding the effect of aerobic exercises in treating cognitive impairments and they contradict with the results in researches done by Edmeno, Peterson *et al.*, (2010), and Doway *et al.*, (1998). Results of this research showed that aerobic exercises with intensity of %60 to %80 for the time period between 4 to 6 months can affect the treatment of cognitive impairments, ignorance, and memory weaknesses. Also studying the difference between minimal cognitive impairment scores of testees in test group has been increasing and this difference has been meaningful compared with the previous stage. Results of this research accord with the research carried out by Lorad *et al.*, (2010) that stressed about the effect of the time span of aerobic exercise administration in reducing cognitive impairments. Of course, the results showed that the scores of control group have been progressive during a time period starting from administration and posttest and this could be due to lack of complete control of testees in this group, diet changes, using other drugs, … . One of the main mechanisms regarding the relationship between body movement and cognition is the optimal flow of vessels towards the brain. Body movements can reinforce brain profusion and reduce high blood pressure in those who suffer from blood pressure (Volton *et al.*, 2002) and this can be recognized as a risky factor in being infected by cardiovascular diseases and impairment (Stephanic *et al.*, 1998). In a review carried out by Cottman & Breshtold (2002), it was pointed out that in addition to increasing the intensity of brain neuro-trophic factors, bodily exercises stimulate genes that have been predicted to be useful for brain flexibility processes such as creating new vessels, neurogenesis, and functional changes in neural structure and neural resistance against hurts.

REFERENCES

Androly C and Greeks L (2001). *Neural Diseases (Internal Treatment of Sisil)*, translated by Solmaz Hasanaliuzadeh & Samira Sadrkhanloo (Golban Publications) Tehran.

Adams M and Victorr S (2002). *Manual of Neurology* (Handbook).

Baker L, Frank L, Foster-Schubert K, Green P, Wilkinson H, Tiernan A, Plymate S and Mark A (2010). Effects of Aerobic Exercise on Mild Cognitive Impairment. *JAMA Neurology* **67**(1) 71-79.

Bherer L, Erickson E and Liu-Ambrose T (2013). A Review of the Effects of Physical Activity and Exercise on Cognitive and Brain Functions in Older Adults. *Journal of Aging Research* **54**(6) 78-86.

Bradly W (2004). Neurology in clinical practical Fourth, Un published Manuscript. London: Institute of psychiatry.

Burns JM, Cronk BB and Anderson HS (2008). Cardiorespiratory fitness and brain atrophy in early Alzheimer disease. *Neurology* **71**(3) 210–216.

Colcombe S and Kramer A (2003). Fitness effects on the cognitive function of older adults: a meta-analytic study. *Psychological Science* **14**(2) 125–130.

Colcombe S, Erickson K and Raz N (2003). Aerobic fitness reduces brain tissue loss in aging humans. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* **58**(2) 176–180.

Cotman CW, Berchtold NC and Christie LA (2007). Exercise builds brain health: key roles of growth factor cascades and inflammation. *Trends in Neurosciences* **30**(9) 464–472.

Cuerva AG, Sabe L, Kuzis G, Tiberti C, Dorrego F and Starkstein SE (2001). Theory of mind and pragmatic abilities in dementia. *Neuropsychiatry, Neuropsychology and Behavioral Neurology* **14** 153–158.

Cyarto V, Cox Kay L, Almeida O, Flicker L, Ames1 D, Byrne G, Hill1 KD, Beer CD, Appadurai K, Irish M, Renehan E and Lautenschlager NT (2010). The fitness for the Ageing Brain Study II (FABS II): protocol for a randomized controlled clinical trial evaluating the effect of physical activity on cognitive functioninpatients with Alzheimer'sdisease. *TRIALS* **11** 120.

Dennerstrin L, Dudley E and Hopper J *et al.*, (2000). A prospective population based study of menopausal symptoms. *Obstetrics & Gynecology* **96**(3) 351- 358.

Duey WJ, Obrian WL and Crutch Field AB (1998). Effect of exercise training on aerobic fitness in African – American females. *Ethnicity & Disease* **8**(3) 306- 110.

Folstein MF, Folstein SE and McHugh PR (1975). Minimental state': a practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* **12** 189–198.

Friedman R and Tappen RM (1991). The effect of planned walking on communication in Alzheimer's disease. *Journal of the American Geriatrics Society* **39** 650–654

Knopman DS and Boeve BF (2003). Petersen RC Essentials of the proper diagnoses of mild cognitive impairment, Dementia and major subtypes of dementia. *Mayo Clinic Proceedings* **78**(10) 1290-1308.

Lautenschlager NT, Cox KL, Flicker L, Fos- ter JK, Van Bockxmeer FM, Xiao J, Greenop KR and Almeida OP (2008). Effect of physical activity on cognitive function in older adults at risk for Alzheimer disease: a randomized trial. *JAMA* **300** 1027–1037.

Larson EB, Wang L and Bowen JD *et al.*, (2006). Exercise is associated with reduced risk for incident dementia among persons 65 years of an age or older. *Annals of Internal Medicine* **144** 73-81.

Nagahara AH, Merrill DA and Coppola G *et al.*, (2009). Neuroprotective effects of brain-derived neurotrophic factor in rodent and primate models of Alzheimer's disease. *Nature Medicine* **15**(3) 331–337.

Petersen RC (2004). Mild cognitive impairment as a diagnostic entity. *Journal of Internal Medicine* **256**(3) 183–194.

Sajatovic M and Ramirez L (2003). Rating scales in Mental Health, Lexi COMP.

Thibault G (2002). *Protocol for the Maximum Aerobic Pow*er (MAP). Canada; Canadian Cycling Association **320** 26.